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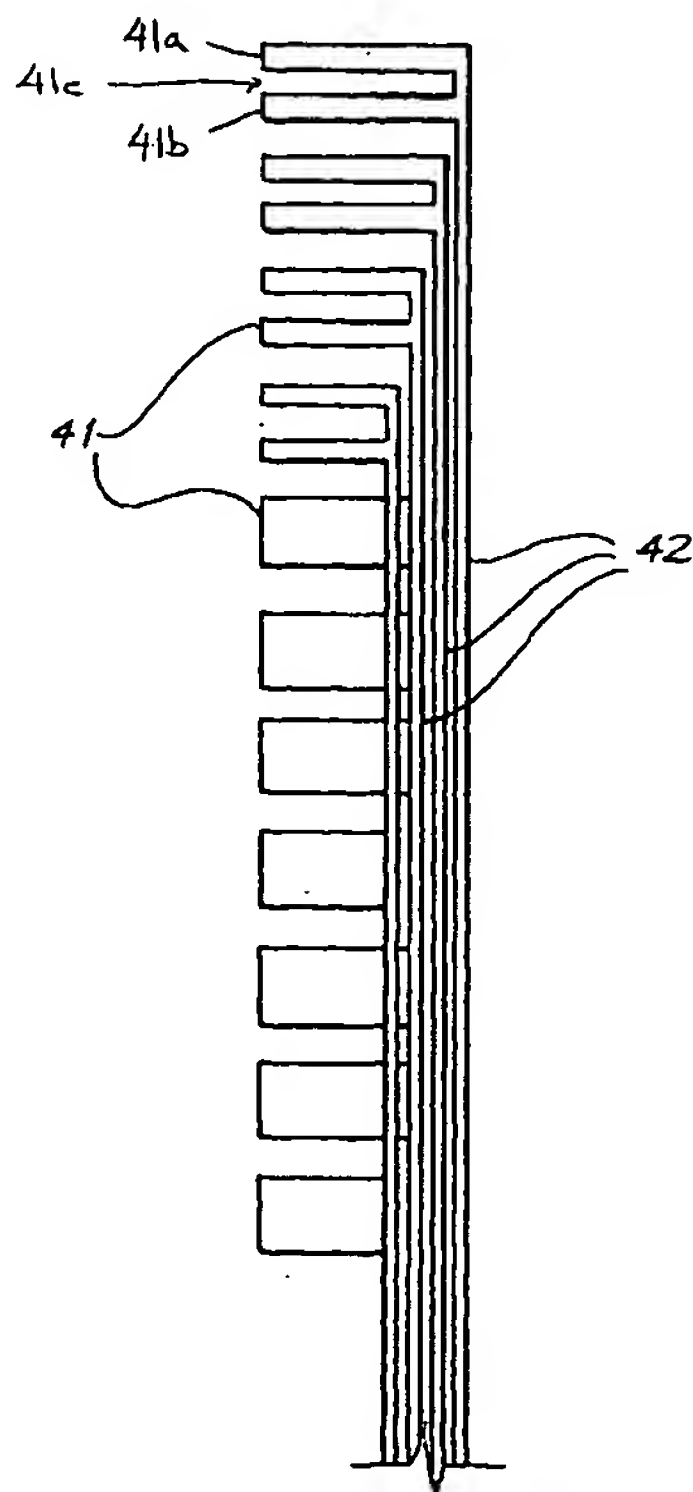
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(54) Title: ELECTRODE ARRAY FOR A COCHLEAR IMPLANT HAVING ONE OR MORE ADJUSTABLE ELECTRODES



(57) Abstract: An electrode array for a tissue-stimulating prosthesis, such as a cochlear implant. The electrode array is comprised of a plurality of electrodes (41), wherein at least one electrode of the array is comprised of at least two electrically connected portions (41a, 41b) that are adjustable in orientation relative to each other. This adjustability in orientation preferably allows the array to adopt a tighter curvature than would be the case were the electrode portions not relatively adjustable to each other.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ELECTRODE ARRAY FOR A COCHLEAR IMPLANT HAVING ONE OR
MORE ADJUSTABLE ELECTRODES

Field of the Invention

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The present invention relates to an implantable electrode array and, in particular, a cochlear implant electrode assembly.

Background of the Invention

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Hearing loss, which may be due to many different causes, is generally of two types, conductive and sensorineural. In some cases, a person may have hearing loss of both types. Of them, conductive hearing loss occurs where the normal mechanical pathways for sound to reach the hair cells in the cochlea are impeded, for example, by damage to the ossicles. Conductive hearing loss may often be helped by use of conventional hearing aids, which amplify sound so that acoustic information does reach the cochlea and the hair cells.

In many people who are profoundly deaf, however, the reason for their deafness is sensorineural hearing loss. This type of hearing loss is due to the absence of, or destruction of, the hair cells in the cochlea which transduce acoustic signals into nerve impulses. These people are thus unable to derive suitable benefit from conventional hearing aid systems, no matter how loud the acoustic stimulus is made, because there is damage to or absence of the mechanism for nerve impulses to be generated from sound in the normal manner.

It is for this purpose that cochlear implant systems have been developed. Such systems bypass the hair cells in the cochlea and directly deliver electrical stimulation to the auditory nerve fibres, thereby allowing the brain to perceive a hearing sensation resembling the natural hearing sensation normally delivered to the auditory nerve.

Cochlear implant systems have generally consisted of essentially two components, an external component commonly referred to as a processor unit and an internal implanted component commonly referred to as a

receiver/stimulator unit. Traditionally, both of these components have cooperated together to provide the sound sensation to a recipient.

The external component has traditionally consisted of a microphone for
5 detecting sounds, such as speech and environmental sounds, a speech processor that converts speech into a coded signal, a power source such as a battery, and an external transmitter coil.

The coded signal output by the sound processor is transmitted
10 transcutaneously to the implanted receiver/stimulator unit situated within a recess of the temporal bone of the recipient. This transcutaneous transmission occurs via the external transmitter coil which is positioned to communicate with an implanted receiver coil provided with the receiver/stimulator unit. This communication serves two essential purposes, firstly to transcutaneously
15 transmit the coded sound signal and secondly to provide power to the implanted receiver/stimulator unit. Conventionally, this link has been in the form of a radio frequency (RF) link, but other such links have been proposed and implemented with varying degrees of success.

20 The implanted receiver/stimulator unit traditionally includes a receiver coil that receives the coded signal and power from the external processor component, and a stimulator that processes the coded signal and outputs a stimulation signal to an intracochlea electrode assembly which applies the electrical stimulation directly to the auditory nerve producing a hearing
25 sensation corresponding to the original detected sound.

It is known in the art that the cochlea is tonotopically mapped. In other words, the cochlea can be partitioned into regions, with each region being responsive to signals in a particular frequency range. This property of the
30 cochlea has been exploited by providing the electrode assembly with an array of electrodes, each electrode being arranged and constructed to deliver a stimulating signal within a preselected frequency range, to the appropriate region within the scala tympani of the cochlea. The electrical currents and electric fields from each electrode stimulate the nerves disposed on the
35 modiolus of the cochlea.

To achieve good positioning of the electrode assembly, it is desirable that the array be inserted relatively deeply into the scala tympani of the cochlea and positioned as close as possible to the inner wall of the cochlea to enable direct stimulation of the appropriate auditory nerves cells disposed in the modiolus of the cochlea. For this reason, electrode arrays having a shape adapted to conform to the shape of the modiolus of the cochlea have been developed, such as that described in the Applicant's US Patent No. 6,421,569.

The present invention therefore assists in achieving this outcome to achieve optimal placement of the electrodes of the electrode array.

Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is solely for the purpose of providing a context for the present invention. It is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed in Australia before the priority date of each claim of this application.

Summary of the Invention

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Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

According to a first aspect, the present application is directed to a first invention comprising an electrode array for a tissue-stimulating prosthesis, the electrode array comprising a plurality of electrodes, wherein at least one electrode of the array is comprised of at least two electrically connected portions that are adjustable in orientation relative to each other.

This adjustability in orientation preferably allows the array to adopt a tighter curvature than would be the case were the electrode portions not relatively adjustable to each other.

In one embodiment, the electrode array can comprise one of a plurality of stacked but laterally off-set electrode sets used for a tissue-stimulating prosthesis.

5 In a further embodiment, the array is supported in a carrier member. The carrier member can have a leading end and a trailing end. The array preferably extends from a position at or adjacent the leading end back along the carrier member towards the trailing end. In one embodiment, said at least one adjustable electrode is adjacent the leading end of the carrier member. In
10 another embodiment, said at least one adjustable electrode can be at a location where adjustability is more likely to be required following insertion of the array. In one embodiment, the array can comprise adjustable electrodes interspersed between other non-adjustable electrodes. In one embodiment, at least some adjustable electrodes can be positioned side-by-side in the array.

15 Each adjustable electrode can comprise two or more portions. Each portion preferably extends outwardly from a common conducting portion. In one embodiment, a gap can be present between the portions of the electrode. In another embodiment, the gap can be bridged by one or more bridge
20 members. In one embodiment, the bridge member can extend between the portions at a location distal the common conducting portion. Each or some of the bridge members can have a thickness equal to or different than that of the electrode portions. In another embodiment, the portions can be linked by a region that fully or substantially closes the gap and which has a thickness less
25 than that of the adjacent portions. In one embodiment, the region that fully or substantially closes the gap can have a substantially V-shaped cross-section, with the electrode preferentially bendable at this location.

Each portion is preferably fabricated so as to be in a common plane and
30 are then adjustable in orientation relative to this plane on implantation of the array. Each portion of each said adjustable electrode is preferably rectangular in shape, however any shape is envisaged as being within the scope of the present invention. Respective portions of each said adjustable electrode are also preferably of about equal dimensions. It will be appreciated that the
35 respective portions could, however, be of different shapes and/or sizes compared to each other.

The respective portions of each said adjustable electrode are preferably separated by a gap. The gap is preferably present on manufacture of the electrode array. During implantation, the gap can be closed as the portions
5 move towards one another. For example, if the carrier member adopts a spirally curved configuration, the respective portions can undergo a change in orientation relative to the said common plane and so come into contact with each other.

10 In a further embodiment, the electrodes are formed from a biocompatible conductive material such as platinum or iridium. The electrodes can be formed from a sheet of platinum or an alloy. The sheet or foil can have a thickness of between about 1, 2, 5 or 10 and 50 microns. Each formed electrode can have a conducting portion extending away therefrom to a location distal the
15 electrode. Each portion of each of said adjustable electrodes has at least one common conducting portion extending away therefrom. Each conducting portion can extend lineally away from its electrode. The respective linear conducting portions are preferably aligned in a parallel arrangement. The conducting portions are hereinafter referred to as "wires" as they serve to
20 provide electrical conduction between each electrode to a location distal the electrode array.

In a further embodiment, the electrodes and wires can be formed using machining processes as defined in International Patent Publication No WO
25 02/089907 of the present applicant. For example, the electrodes and wires can be formed using electrical discharge machining (EDM), milling, cutting, or etching.

In another embodiment, the electrodes and wires can be formed using
30 conventional processes, such as those described in the Applicant's US Patent No. 6,421,569, the contents of which is incorporated herein by reference. In this regard, each of the electrodes can be a conductive pad, made from a suitable biocompatible material, such as platinum, with conventional wires welded to each of the electrodes providing electrical conduction between each
35 electrode to a location distal the electrode array. Each portion of each of the

adjustable electrodes has at least one conducting portion extending away therefrom.

In a preferred embodiment, the array comprises 30 electrodes, with the
5 array comprising at least 4 of said adjustable electrodes. Where the array
comprises 30 electrodes, the array can comprise 5 different sets of electrodes
that have been formed individually and then stacked one on top of the other to
form a single electrode array. Where the array comprises 30 electrodes, the
array can comprise 3 sets of seven electrodes, 1 set of 5 electrodes and 1 set
10 of 4 adjustable electrodes. In this embodiment, the 3 sets of 7 electrodes are
stacked one on top of the other, the set of 5 electrodes is stacked on these
sets, with the set of 4 electrodes on top of the stack. Other combinations of
sets can, however, be envisaged, for example 1 set of 3 electrodes with
adjustable electrodes at the tip to curve to a smaller radius, 1 set of 4, 1 set of 5
15 & 3 sets of 6.

While the sets of electrodes are stacked one upon the other, it will be
appreciated that the actual position of the electrodes in each set are not
necessarily vertically aligned. Rather, the set immediately above its lower set
20 may be laterally offset so as to ensure the electrodes are visible from beneath
the stack.

The wires extending from each electrode are preferably of the same
length. It can, however, be envisaged that the wires could be formed with
25 different lengths to account for the ultimate offset present when forming the
stack.

Once the stack is formed, the hitherto at least substantially planar
electrodes are preferably deformed so as to at least partially extend through a
30 third dimension. In a preferred embodiment, each of the electrodes is curved
out of the plane of the wires for each set of electrodes. The curvature can be
substantially semi-circular. A mandrel can be used to form the curvature in the
electrodes.

35 Once the electrodes have been deformed to have a substantially semi-
circular curvature, each of the electrodes can be further folded about a

longitudinal axis of the array. This folding of the electrodes preferably serves to bend the electrodes around the wires of the array. The electrodes can be folded individually, in small groups, or all together. In one embodiment, the electrodes are folded so as to define a lumen that extends through the array.

5

Once the electrode array is complete it can be encapsulated in a further layer of a biocompatible relatively insulating material to form the electrode carrier member. In a preferred embodiment, the biocompatible material can be a silicone, such as a flexible silicone elastomer-Silastic. Silastic MDX 4-4210 is
10 an example of one suitable silicone for use in the formation of the carrier member. In another embodiment, the elongate carrier member can be formed from a polyurethane or similar material.

In another method, the body of the array can be formed, with the wiring
15 then adhered to the array before the electrodes are bent around the body.

In one embodiment, the carrier member can be formed in a mould with the biocompatible material allowed to set around the array. In this embodiment, the electrodes are preferably positioned in the mould so as to not
20 be coated with the biocompatible material. In one embodiment, the carrier member can be moulded in a straight configuration. In another embodiment, the carrier member can be moulded in a curved configuration, such as a spirally-curved configuration.

25 In a preferred embodiment, the electrode array is for use as an implantable tissue-stimulating device. More preferably, the tissue-stimulating device is a cochlear electrode assembly, more preferably an intracochlear electrode assembly.

30 In a preferred embodiment, the intracochlear electrode assembly is a part of an implanted component of a cochlear implant system. The implanted component further preferably comprises a receiver coil and a housing for a stimulator device. The carrier member preferably extends outwardly from the housing of the stimulator device.

35

In a further embodiment, the leading end of the carrier member is insertable into a cochlea of a recipient. The wires of the electrode array preferably extend back towards the trailing end of the carrier member.

5 The wires preferably extend back to the housing to at least a first feedthrough in the wall of the housing. The wires are preferably exposed at or adjacent the trailing end to allow connection to the feedthroughs. In one embodiment, the feedthrough provides hermetic and insulated electrical connection for each wire extending from the electrode assembly into the
10 housing of the implantable component. Each feedthrough can be formed using the method described in US Patent 5046242, the contents of which are incorporated herein by reference.

In a preferred embodiment, the orientation of the carrier member as it is
15 firstly inserted through a cochleostomy into the cochlea is preferably substantially straight. More preferably, the implantable orientation is straight. Following completion of implantation, the carrier member preferably adopts a spirally curved configuration that at least substantially matches the spiral nature of the scala tympani of the human cochlea. The carrier member is preferably
20 pre-formed with this spiral configuration and is then straightened either during manufacture and packaging of the device or prior to implantation. The carrier member is preferably held straight prior to and at least during the initial stages of implantation by a stylet. The stylet preferably extends through a lumen of the carrier member such as the lumen described herein that is formed by the
25 folding of the electrodes about the wires.

As the carrier member is inserted into the scala tympani of the cochlea, the degree of curvature required of the array becomes tighter if the array is to be implanted to a desired depth within the cochlea. The ability of the portions
30 of the leading end electrodes to adjust in orientation relative to each other during this process serves to allow the carrier to adopt a tighter degree of curvature than would otherwise be the case.

Further, the provision of electrode elements having portions that are
35 capable of adjusting in orientation relative to each other allows conventional electrode arrays to become more flexible along their length. This improved

flexibility is achievable without needing to revert to smaller electrode elements of reduced surface area, which may reduce the ability of the electrode elements to provide optimum stimulation and broad current spread. Therefore, the present invention potentially opens up a new realm for electrode array design
5 where flexibility and stiffness of the array can be reduced without the need for reducing the stimulating surface area of the array.

In a further embodiment, the housing is preferably implantable in a recess of the temporal bone adjacent the ear of the recipient that is receiving
10 the output of the implant system. The housing is preferably formed from a biocompatible material or has a biocompatible coating. The housing can be coated with a layer of silicone or parylene.

As already discussed, the implantable component preferably also
15 comprises a receiver coil. The receiver coil preferably comprises a wire antenna coil. The antenna coil can be comprised of at least one, and preferably at least two, turns of electrically insulated platinum or gold wire tuned to parallel resonance by a capacitor internal to the housing. The electrical insulation of the antenna coil can be provided by a flexible silicone moulding
20 and/or silicone or polyurethane tubing. The external coil can be constructed in a similar fashion to the implanted coil or have a different construction.

The antenna coil is preferably external of the housing. Electrical connection between the antenna coil and componentry of the implantable
25 componentry within the housing can be provided by two hermetic and electrically insulated ceramic feedthroughs or an electrical conductor. The ceramic feedthroughs can be formed using the method described in abovementioned US Patent 5046242.

30 The antenna coil of the implantable component preferably acts as part of the radio frequency (RF) link to allow transcutaneous bidirectional data transfer between the implantable component and external components of the cochlear implant system. The radio frequency signals can comprise frequency modulated (FM) signals. While described as a receiver coil, the receiver coil
35 can preferably transmit signals to the transmitter coil which receives the signals.

The link between the two coils also provides a means of powering the componentry of the internal component. Where the implantable component further has an on-board or implantable power source, such as a rechargeable
5 battery, the link can provide a means of inductively charging the battery when required.

The implanted housing preferably contains, in addition to the stimulator device, a receiver device. The receiver device is preferably adapted to receive
10 signals from the external component.

The housing of the external component preferably houses a speech processor adapted to receive signals output by a microphone. In a preferred embodiment, the microphone can be mounted to the housing or an ear hook
15 member. Other suitable locations for the microphone and/or the housing for the speech processor can be envisaged, such as a lapel of the recipient's clothing.

The speech processor encodes the sound detected by the microphone
20 into a sequence of electrical stimuli following given algorithms, such as algorithms already developed for cochlear implant systems. The encoded sequence is transferred to the implanted receiver/stimulator device using the transmitter and receiver coils. The implanted receiver/stimulator device demodulates the FM signals and allocates the electrical pulses to the
25 appropriate attached electrode by an algorithm which is consistent with the chosen speech coding strategy.

The external component preferably further comprises a power supply. The power supply can comprise one or more rechargeable batteries. The
30 transmitter and receiver coils are used to provide power via transcutaneous induction to the implanted stimulator/receiver device and the electrode array.

While the implant system can rely on external componentry, in another embodiment, the microphone, speech processor and power supply can also be
35 implantable. In this embodiment, these components can be contained within a hermetically sealed housing or the housing used for the stimulator device.

Brief Description of the Drawings

By way of example only, a preferred embodiment of the invention is now
5 described with reference to the accompanying drawings, in which:

Fig. 1 is a plan view of a platinum sheet depicting how different sets of
electrodes and adjoining wires can be formed in a platinum sheet through
appropriate machining;

10

Figs. 1a and 1b are enlarged plan views and Fig. 1c is an enlarged
perspective view of adjustable electrodes for use in the array depicted in Fig. 1;

Fig. 2 is a plan view of stacked sets of electrodes of an electrode array
15 suitable for use in a cochlear implant system according to the present
invention; and

Fig. 3 is a view of a carrier member with a stylet at least partially
retracted thereby allowing the carrier member to adopt a more pronounced
20 curvature.

Preferred Mode of Carrying out the Invention

Fig. 1 depicts 5 different sets of electrodes and associated wires that
25 have been formed on a single sheet of platinum foil. This figure depicts the
electrode sets prior to them being trimmed from the platinum sheet. Each of
the sets 51-55 have been formed in the sheet using electrical discharge
machining (EDM) as defined in International Patent Publication No WO
02/089907 described above.

30

Once each of the sets 51-55 are formed, each set can be trimmed from
the platinum sheet and stacked one above the other to form an aligned array of
electrodes 41. In the embodiment depicted in Fig. 1, the electrode array
comprises 30 electrodes, with the array comprising 3 stacked sets of 7
35 electrodes (51-53), 1 set of 5 electrodes (54) above these, and 1 set of 4
electrodes (55) on top of the stack.

While the sets of electrodes are stacked one upon the other, it will be appreciated that the actual position of the electrodes 41 from the respective sets are not necessarily vertically aligned. Rather, the set immediately above
5 its lower set may be laterally offset so as to ensure the electrodes are visible from beneath the stack. A drawing depicting a part of an example of a longitudinal array of electrodes 41 according to the present invention is depicted in Fig. 2.

10 As is depicted more clearly in Fig. 1a, each of the electrodes 41 of electrode set 55 can be so-called split electrodes. Each electrode in this set is comprised of a first portion 41a and a second portion 41b, with the portions being separated by a longitudinal gap 41c. On manufacture, the portions 41a, 41b extend outwardly in a plane from a common conducting portion or wire 42.

15

In another embodiment depicted in Fig. 1b, the gap 41c can be bridged by a bridge member 41d. As depicted, the bridge member 41d can extend between the portions 41a and 41b at a location distal the common conducting portion 42. While a single bridge member is depicted in Fig. 1b, more than one
20 such bridge member could be present.

In another embodiment depicted in Fig. 1c, the portions can be linked by a region 41e that closes the gap between the portions 41a and 41b and which has a thickness less than that of the adjacent portions. As depicted, the region
25 41e can have a substantially V-shaped cross-section, with the electrode preferentially bendable at this location. It will be appreciated that the region 41e could only bridge a portion of the gap, for example, the region 41e could bridge the gap adjacent or near the common conducting wire 42.

30 Each electrode 41 has an associated wire 42 that extends from its respective electrode at least towards the trailing end of the carrier member in which the electrode array is supported. As depicted in Fig. 1, each wire extends lineally away from its electrode in a parallel arrangement with adjacent wires.

35

While the depicted embodiments depict the electrodes and "wires" as being formed from the same sheet of platinum as that used to form the electrodes, it will be appreciated that both the electrodes and wires could be formed using conventional processes, such as those described in the
5 Applicant's US Patent No. 6,421,569, the contents of which is incorporated herein by reference, and still fall within the scope of the present invention. In this regard, each of the electrodes can be a conductive pad, made from a suitable biocompatible material, such as platinum, with conventional wires welded to each of the electrodes providing electrical conduction between each
10 electrode to a location distal the electrode array. For example, Fig. 3 could be readily interpreted as depicting conductive platinum pads 41 to which conventional wires are welded and which then extend back through the length of the carrier member 60.

15 Once the stack is formed, the hitherto at least substantially planar electrodes 41 are preferably deformed so as to at least partially extend in a third dimension. In a preferred embodiment, each of the electrodes is curved out of the plane of the wires 42 for each set of electrodes. The curvature can be substantially semi-circular. A mandrel can be used to form the curvature in
20 the electrodes.

Once the electrodes 41 have been deformed to have a substantially semi-circular curvature, each of the electrodes 41 are further folded about a longitudinal axis of the array 40. This folding of the electrodes 41 serves to
25 bend the electrodes around the wires 42 of the array. The electrodes are preferably folded together and define a lumen that extends through the array 40. An example of the curvature of individual electrodes is depicted in Fig. 3.

Once the electrode array 40 is complete it is encapsulated in a further
30 layer of a biocompatible relatively insulating material such as silicone to form an electrode carrier member 60. Silastic MDX 4-4210 is an example of one suitable silicone for use in the formation of the carrier member 60.

The step of forming the carrier member 60 can comprise mounting the
35 array in a mould and filling the mould with the silicone and allowing it to cure. In this arrangement, the electrodes are positioned in the mould so as to not be

coated with the silicone. In the arrangement depicted in Fig. 3, the carrier member is moulded in a spirally-curved configuration and preferentially adopts this configuration unless straightened by the presence of a stylet or other straightening device. In Fig. 3, the degree of curvature of the depicted carrier member is to be taken as illustrative only.

In Fig. 3, the stylet passes through a lumen in the carrier member 60 formed by the folding of the electrodes 41 as defined above. When the carrier member 60 is in the configuration depicted in Fig. 3, the stylet has been at least partially retracted to allow the carrier member 60 to begin to adopt its preferred spirally curved configuration.

As the carrier member begins to curve, the adjustable nature of the electrodes 41 adjacent the tip of the carrier 60 allows these electrodes to adjust in orientation relative to each other and so allows the array to adopt a tighter curvature than would otherwise be the case. Such an arrangement ensures that the stimulating surface area of the electrode elements throughout the array can be kept relatively constant, thereby ensuring a uniform current spread from each of the electrodes employed in the array, from the most basal electrode to the most apical electrode. This arrangement therefore overcomes the need to reduce the surface area/size of the most apical electrodes to enable that region to be at its most flexible to achieve a greater amount of curvature.

While the depicted embodiment has adjustable electrodes adjacent the tip of the carrier, the array could be constructed of adjustable electrodes and non-adjustable electrodes, with the adjustable electrodes formed in the array at locations where that adjustability is a greater requirement. For example, each of 30 electrodes, or at least 20 electrodes that will be typically positioned past the basal turn, can be adjustable.

Further, whilst the depicted embodiment has electrodes arranged with a substantially semi-circular arc, the electrodes could be arranged in a more conventional substantially flat manner, such as that described in the Applicant's US Patent No. 6,421,569. In this regard, the adjustable electrodes still function to impart greater adjustability and/or flexibility in the appropriate regions of the array. Further, whilst the depicted embodiment has the electrodes and wires

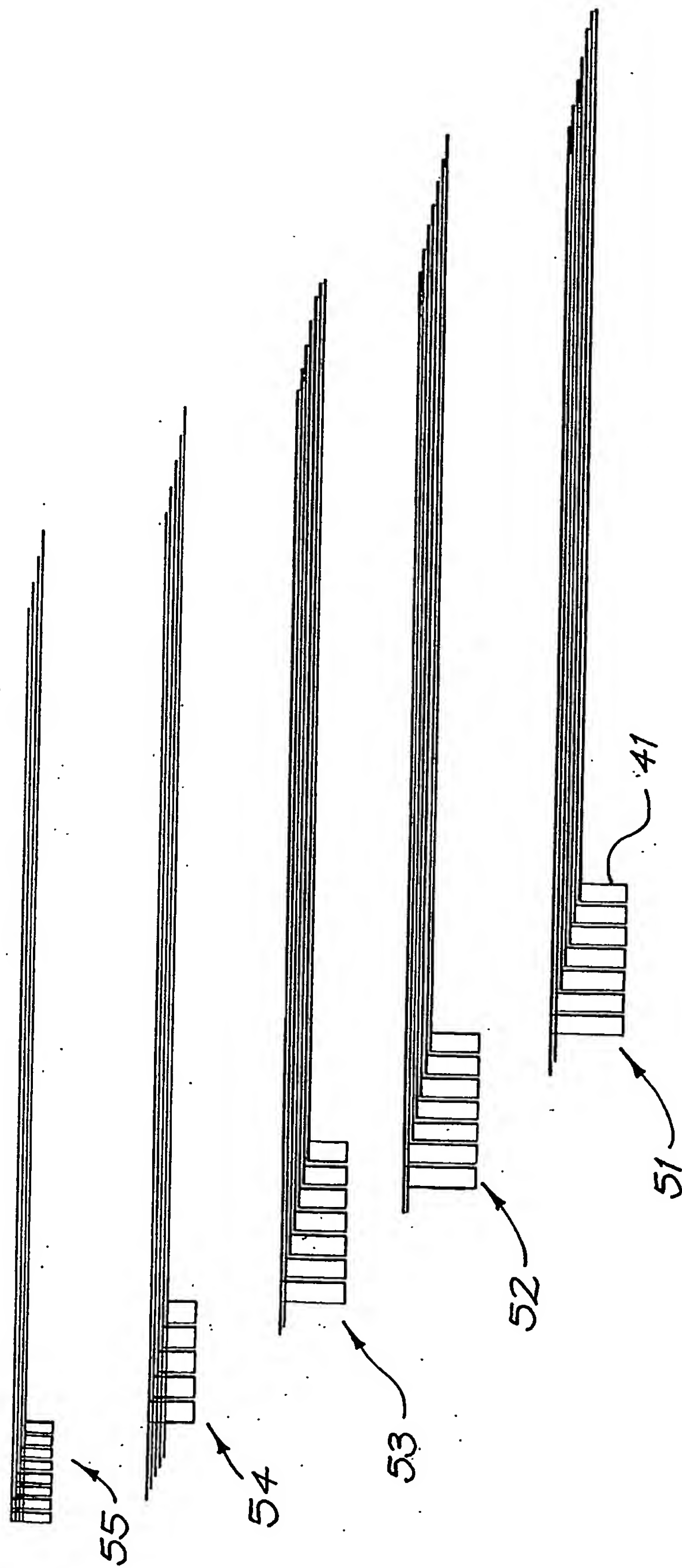
constructed from the one piece, it is also envisaged that the electrodes and the wires could be separately constructed and welded into connection in a more conventional manner.

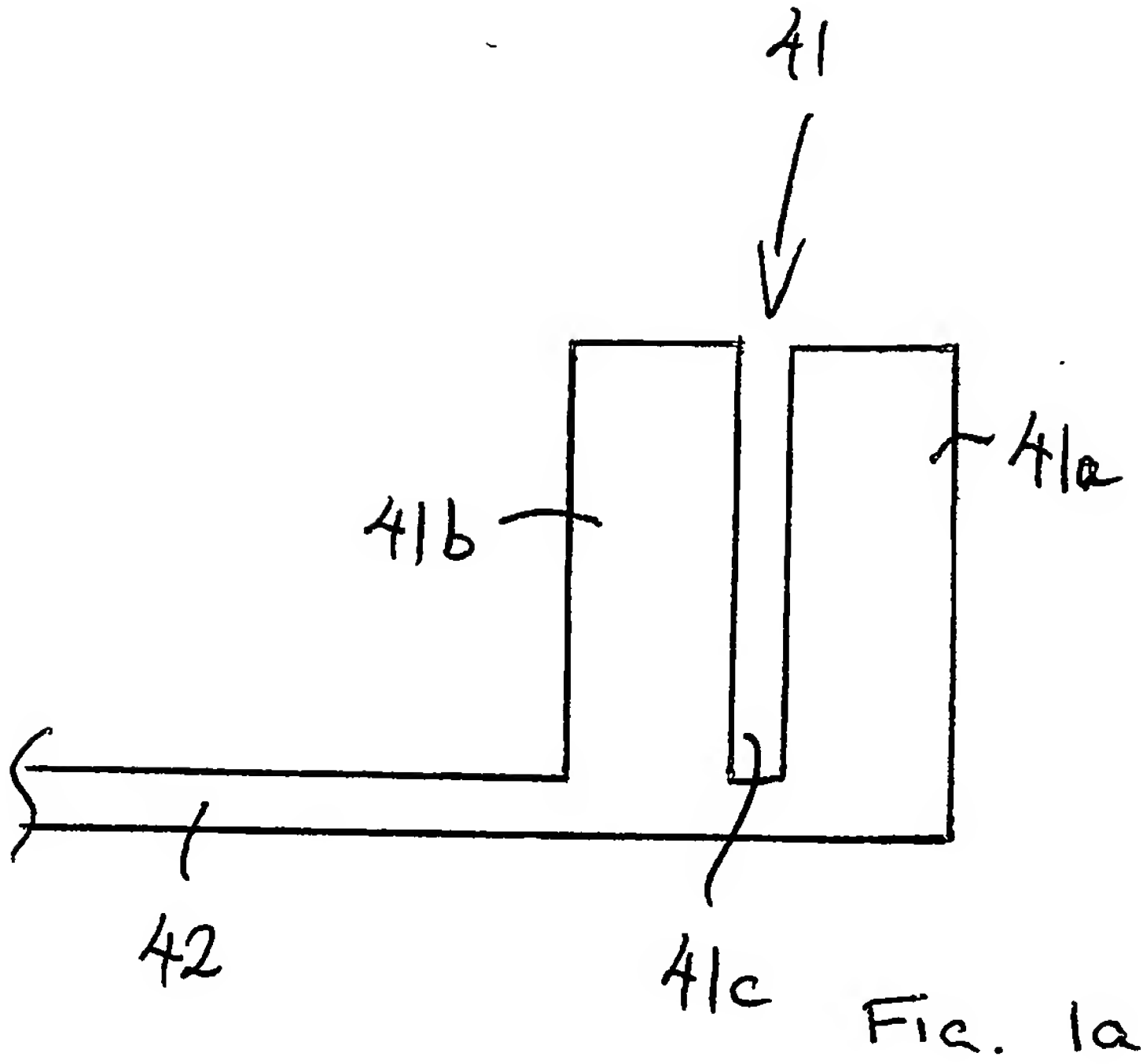
- 5 It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

CLAIMS.

1. An electrode array for a tissue-stimulating prosthesis, the electrode array comprising a plurality of electrodes, wherein at least one electrode of the array
5 is comprised of at least two electrically connected portions that are adjustable in orientation relative to each other.
2. The electrode array of claim 1 wherein the array is supported in a carrier member, the carrier member having a leading end and a trailing end, and the
10 array extending from a position at or adjacent the leading end back along the carrier member towards the trailing end.
3. The electrode array of claim 2 wherein said at least one adjustable electrode is adjacent the leading end of the carrier member.
- 15 4. The electrode array of claim 2 wherein the array comprises one or more adjustable electrodes interspersed between other non-adjustable electrodes.
5. The electrode array of claim 1 wherein each adjustable electrode
20 comprises two or more portions, with each portion extending outwardly from a common conducting portion.
6. The electrode array of claim 5 wherein a gap is present between the portions of the electrode extending outwardly from the common conducting
25 portion.
7. The electrode array of claim 6 wherein the gap is bridged by one or more bridge members.
- 30 8. The electrode array of claim 7 wherein a bridge member extends between the portions at a location distal the common conducting portion.
9. The electrode array of claim 7 wherein the bridge member has a thickness equal to that of the electrode portions.

10. The electrode array of claim 5 wherein the portions are linked by a region that fully or substantially fills any gap between the portions and which has a thickness less than that of the adjacent portions.
- 5 11. The electrode array of claim 10 wherein the region that fully or substantially fills the gap has a substantially V-shaped cross-section, with the electrode preferentially bendable at this location.
12. The electrode array of claim 5 wherein each portion is fabricated so as to
10 be in a common plane and is then adjustable in orientation relative to this plane on implantation of the array.
13. The electrode array of claim 5 wherein each electrode has a conducting portion extending away therefrom to a location distal the electrode.
- 15 14. The electrode array of claim 1 wherein the tissue-stimulating device is a cochlear implant.
15. The electrode array of claim 1 wherein the electrode array comprises
20 one of a plurality of stacked but laterally off-set electrode sets used for a tissue-stimulating prosthesis.





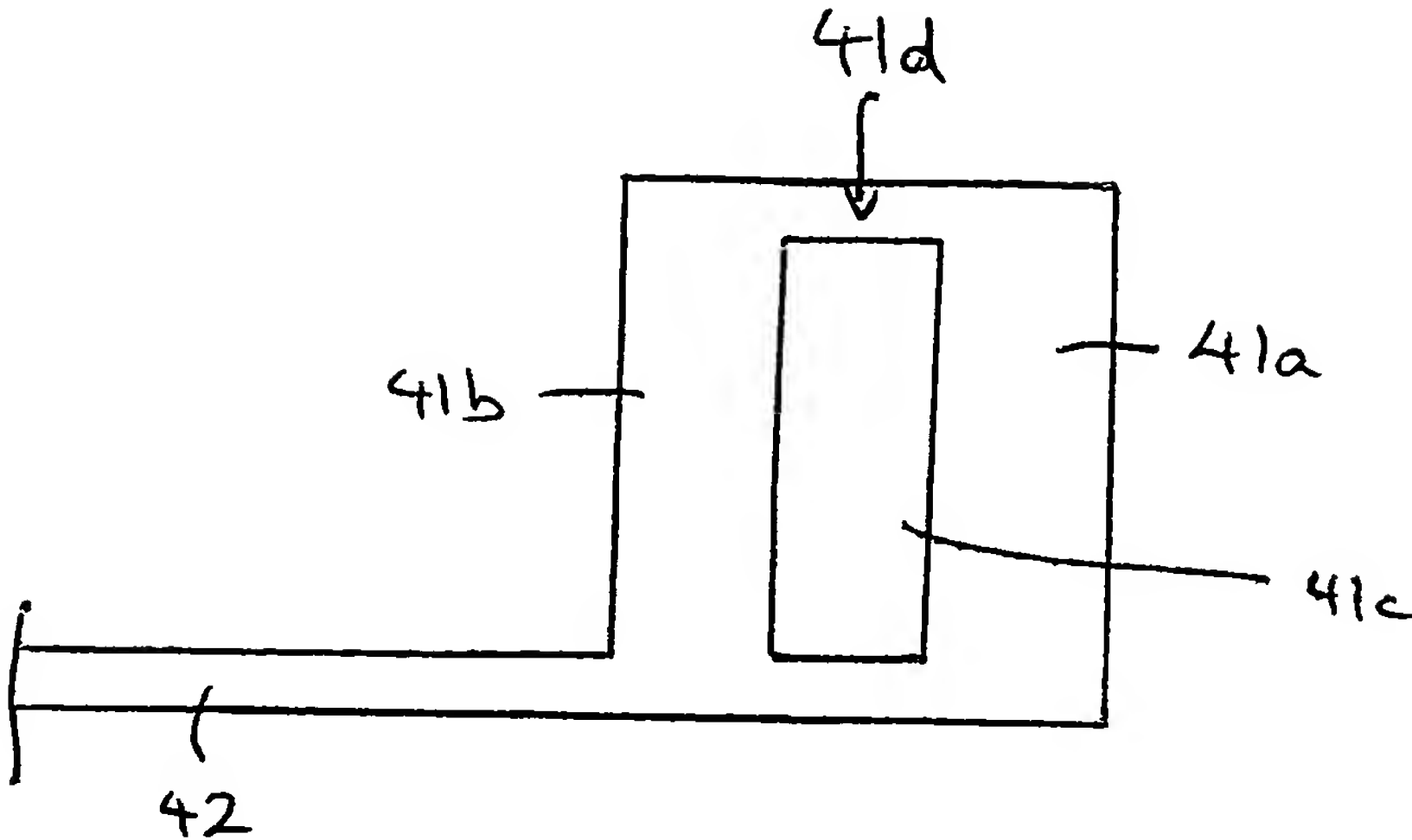


Fig. 1b.

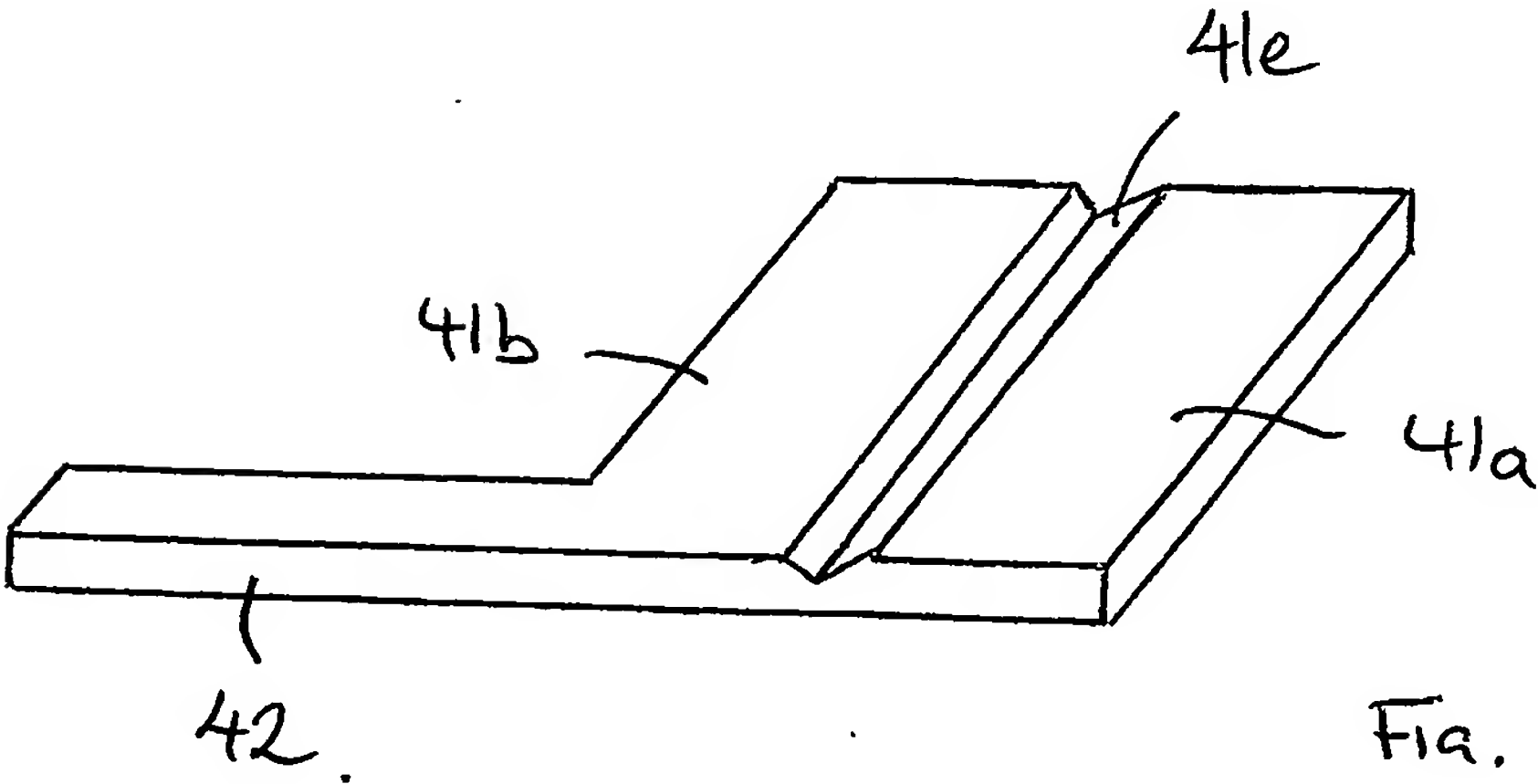


Fig. 1c.

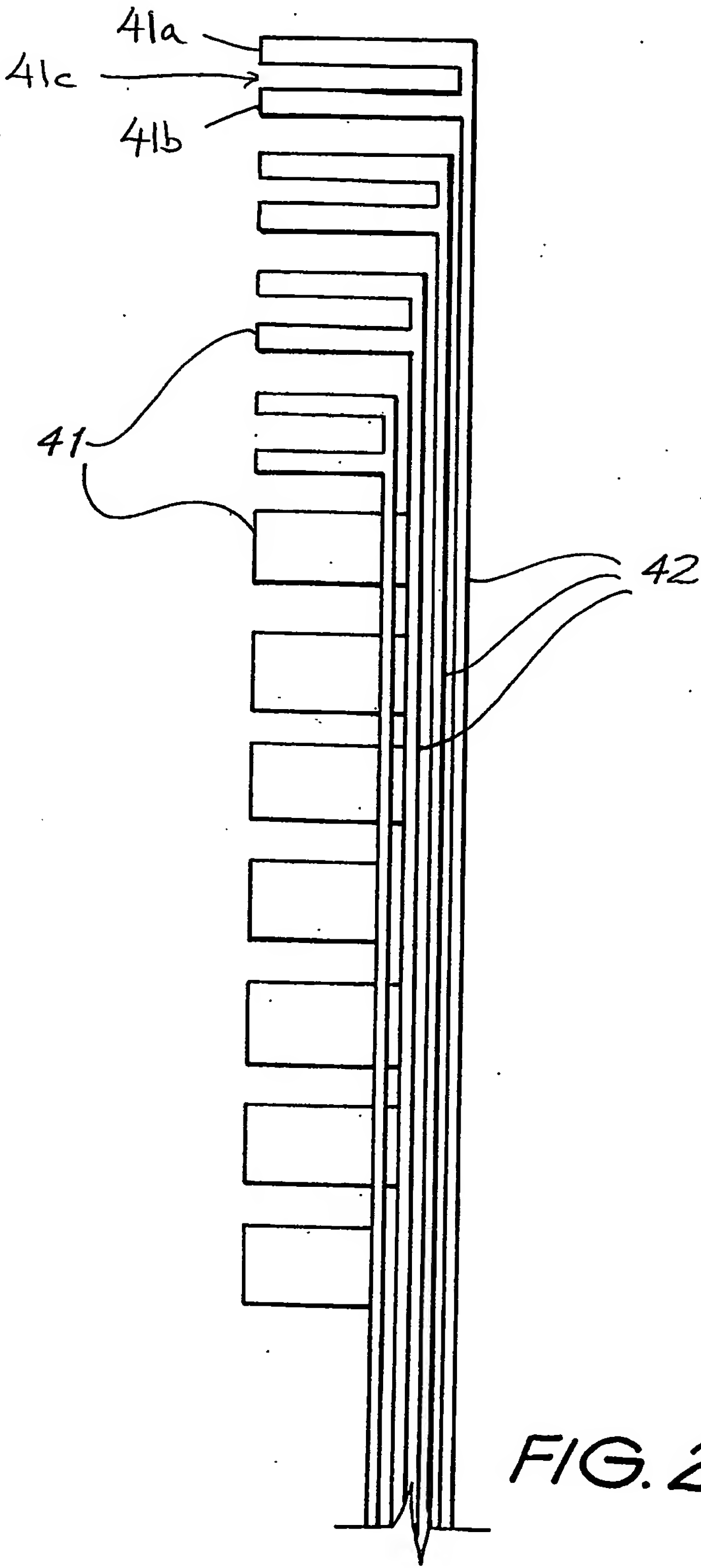
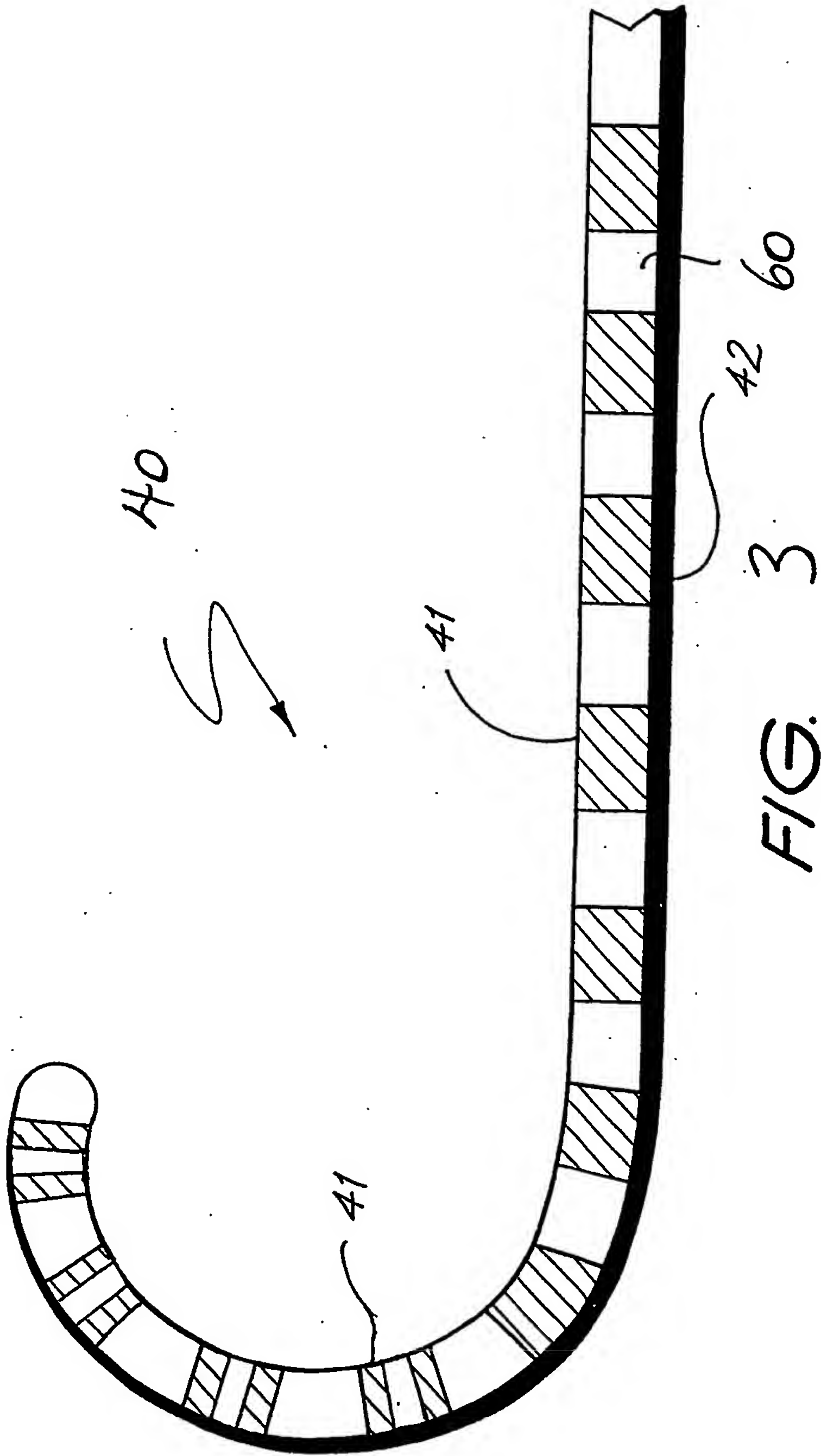


FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/00463

A. CLASSIFICATION OF SUBJECT MATTER												
Int. Cl. ⁷ : A61N 1/05												
According to International Patent Classification (IPC) or to both national classification and IPC												
B. FIELDS SEARCHED												
Minimum documentation searched (classification system followed by classification symbols)												
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched												
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT (electrode, array, assembly, set, tissue, nerve, cochlear, brain, adjust, adapt, flexible, bend, fold, portions, parts, members)												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
X	US 4573481 A (BULLARA) 4 March 1986 The whole document	1-15										
X	US 6119044 A (KUZMA) 12 September 2000 Column 14, lines 8-44, claim 1	1-15										
<input type="checkbox"/> Further documents are listed in the continuation of Box C . <input checked="" type="checkbox"/> See patent family annex												
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention											
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone											
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art											
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family											
"P" document published prior to the international filing date but later than the priority date claimed												
Date of the actual completion of the international search 13 May 2003		Date of mailing of the international search report 27 MAY 2003										
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929		Authorized officer J. Law Telephone No : (02) 6283 2179										

Information on patent family members

PCT/AU03/00463

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	4573481	NONE					
US	6119044	AU	92074/98	CA	2302667	EP	1009475
		US	6038484	US	6045993	US	6078841
		US	6129753	US	6144883	WO	9911321
		US	6149657	US	6163729	US	6195586
		US	6304787	US	6309410	US	6321125
		US	6397110	AU	64049/99	CA	2362478
		EP	1159027	WO	200047272	US	6266568
		US	6125302	US	6070105	AU	43168/99
		CA	2324978	EP	1082466	WO	9963118
		US	6228577	AU	200046550	CA	2367195
		EP	1173250	WO	200064529	AU	200048460
		CA	2371125	EP	1185332	US	6259951
		WO	200069513	US	6503704	AU	200047129
		CA	2370860	EP	1185331	WO	200069512
END OF ANNEX							